MeteoHelix Document

MeteoHelix Data Interpretation

MeteoHelix Devices Metadata

Version 1.0

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Revision History

Rev	Date	Comment	Author
PA1-v1	11/07/2024	Initial draft	Samaneh Ramezani

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1 Introduction:

1.1 Scope:

This document provides a comprehensive explanation of the MeteoHelix sensor data and introduces some key performance indicators (KPIs) associated with these measurements. The MeteoHelix sensors are designed to measure various meteorology-related values, including Temperature, Humidity, Pressure, Irradiation and Rain. Each of these parameters will be explained in detail to offer a clear understanding of their significance and application.

2 MeteoHelix Fields[1]:

Field	Temp	Min Temp	Max Temp	Humidity	Pressure	Irradiation	Max IRR	Rain Counter	Rain Min Time	SVP	VPD	Tdp
unit	$^{\circ}c$[2]	$^{\circ}c$	$^{\circ}c$	%	Pa	W/m^2	W/m^2	pulses	seconds	Kpa	KPa	$^{\circ}c$
Resolution	0.1	0.1	0.1	0.2	5	2	2	Rain Gauge dependent	1	0.01	0.01	0.1
Minimum value	-100	-100	-	0	50000	0	0	0	0	0	0	-100

Table 1 - MeteoHelix sensors' fields

[1] MeteoHelix messages
[2] degree Celsius

2.1 Temp:

The temperature value is calculated as a 10-minute average, with measurements taken at 10-second intervals.

2.2 MinTemp, MaxTemp:

The minimum and maximum temperatures recorded over 10-minute intervals.

2.3 Humidity:

The average humidity measured over 10-minute intervals.

2.4 Pressure:

The atmospheric pressure averaged over 10-minute intervals.

2.5 Irradiation:

The irradiation value is calculated as a 10-minute average, with measurements taken at 10-second intervals.

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2.6 MaxIRR:

The maximum irradiation recorded over 10-minute intervals.

2.7 Rain Counter:

The total amount of rainfall measured over 10-minute intervals.

2.8 RainMinTime:

The RainMinTime refers to the minimum elapsed time between two successive signals from a rain gauge, measured using a revolving counter. This value is essential for determining the maximum instantaneous rainfall rate.

2.9 SVP:

SVP stands for Saturation Vapour Pressure, which is the maximum amount of water vapour that the air can hold at a given pressure.

2.9.1 SVP equation[3]:

$$SVP = 0.61094 * \exp\left(\frac{17.625 * Temp}{Temp + 243.04}\right)$$

Temp is in °C and vapour pressure P is in kilopascals (kPa).

2.10 Relative Humidity:

RH is the proportion of water the air is currently holding versus its maximum capacity. That's why it's called "Relative" humidity[4]. The value reported by the sensor is likely relative humidity since it is measured in percent.

2.10.1 RH equation:

$$RH = \frac{Actual\ Vapour\ Pressure}{SVP} * 100$$

2.11 VPD:

VPD stands for Vapour Pressure Deficit, which indicates the amount of capacity available for humidity in the air at the current temperature.

2.11.1 VPD equation:

$$VPD = SVP * \left(1 - \frac{Relative\ Humidity}{100}\right)$$

[3] reference
[4] reference

2.12 Tdp:

Tdp stands for Temperature of Dew Point, which is the temperature at which the air becomes saturated with moisture and can no longer hold additional water vapor.

2.12.1 TDP equation:

$$Tdp = Temp - \left(\frac{100 - Relative\ Humidity}{5}\right)$$

2.13 Sample data

DeviceID	Timestamp	rawData	msgType	BATTERY	TEMP	MinTEMP	MaxTEMP	HUMIDITY	PRESSURE	IRRADIATION	MaxIRR	RainCounter	RainMinTime	SVP	VPD	Tdp
C2EB49	2024-07-01T00:00:12	0x6f20c106df41c800003eff	1	4.15	15.5	15.4	15.6	73.4	101.48	0	0	62	255	1.75	0.47	10.2
C2EB49	2024-07-01T00:10:12	0x6f208002df41d000003eff	1	4.15	15.4	15.4	15.4	73.4	101.49	0	0	62	255	1.74	0.46	10.1
C2EB49	2024-07-01T00:20:12	0x6f204002e741d800003eff	1	4.15	15.3	15.3	15.3	74.2	101.5	0	0	62	255	1.73	0.45	10.1
C2EB49	2024-07-01T00:30:12	0x6f204002e541d000003eff	1	4.15	15.3	15.3	15.3	74	101.49	0	0	62	255	1.73	0.45	10.1
C2EB49	2024-07-01T00:40:12	0x6f200002dd41d800003eff	1	4.15	15.2	15.2	15.2	73.2	101.5	0	0	62	255	1.72	0.46	9.8
C2EB49	2024-07-01T00:50:11	0x6f200002dd41d000003eff	1	4.15	15.2	15.2	15.2	73.2	101.49	0	0	62	255	1.72	0.46	9.8
C2EB49	2024-07-01T01:00:12	0x6f200002e141d800003eff	1	4.15	15.2	15.2	15.2	73.6	101.5	0	0	62	255	1.72	0.45	9.9
C2EB49	2024-07-01T01:10:11	0x6f1fc106eb41e800003eff	1	4.15	15.1	15	15.2	74.6	101.5	0	0	62	255	1.71	0.43	10
C2EB49	2024-07-01T01:20:11	0x6f1fc102ef41f000003eff	1	4.15	15.1	15	15.1	75	101.51	0	0	62	255	1.71	0.43	10.1

Figure 1 - MeteoHelix sample data

The “rawData” field, which consists of hexadecimal digits, is the source from which other values are extracted.

3 Related KPIs:

One of the main factors affecting air quality is relative humidity, which is the quantity of moisture in the air relative to the maximum amount it could contain at the same temperature. Extremely high or low humidity may affect how air pollutants disperse and change. Relative humidity monitoring, when used as a KPI on air quality dashboards, offers important context for comprehending the ways in which meteorological factors influence the composition of the atmosphere as a whole[5]. Temperature and humidity influence pollutant dispersion and chemical reactions in the atmosphere. Pressure

[5] inetSoft website

affects air density and pollutant concentrations. By calculating and observing the average trends, minimum, maximum, range, and standard deviation for temperature, humidity, irradiation, and pressure, we can study the impact of these elements on air pollution. Additionally, we can calculate the correlation coefficient between these values and the concentrations of various gases to assess their relationships.